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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|--|-------------|----------------------|-----------------------------|------------------------|
| 10/731,373 | 12/09/2003 | Chellappa Balan | 132814-1/YOD GERD:0067 | 4420 |
| 41838 7590 11/14/2007 GENERAL ELECTRIC COMPANY (PCPI) C/O FLETCHER YODER P. O. BOX 692289 HOUSTON, TX 77269-2289 | | | EXAMINER WALKER, KEITH D | |
| | | | ART UNIT 1795 | PAPER NUMBER |
| | | | MAIL DATE 11/14/2007 | DELIVERY MODE PAPER |

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

| | | | |
|------------------------------|--------------------------------------|---|--|
| Office Action Summary | Application No. 10/731,373 | Applicant(s) BALAN, CHELLAPPA | |
| | Examiner Keith Walker | Art Unit 1795 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 16 August 2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-10, 13-17 and 19-35 is/are pending in the application.
- 4a) Of the above claim(s) 20-35 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-10, 13-17 and 19 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Response to Amendment

Claims 1-10, 13-17, 19-35 are pending in the application with claims 20-35 withdrawn from consideration. Claims 1-10, 13-17 & 19 are pending examination as discussed below.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

1. Claim 3 is rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for a mole fraction of hydrogen in the anode exhaust stream between 0.1 and 0.5, does not reasonably provide enablement for having a mole fraction of hydrogen in the anode exhaust higher than 0.5 moles. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make or use the invention commensurate in scope with these claims. As stated on page 9, lines 20-25 and figure 7 of the instant specification, the range disclosed and supported is only between 0.1 and 0.5 moles. The breadth of the claims are not supported by the instant specification and one of ordinary skill in the art would not know how to use the instant specification as a guide for operating the fuel cell system at a mole fraction of hydrogen in the anode exhaust higher than 0.5. Furthermore, the limitation as claimed includes what would amount to 100% hydrogen

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and as such then the fuel cell would not be operating since none of the hydrogen would have been processed by the fuel cell to produce electricity.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1, 3-9, 15 & 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over US 5,084,362 (Farooque) in view of US 7,052,790 (Nakamura).

With respect to claims 1 & 9, Farooque teaches a fuel cell system for co-production of hydrogen and electricity comprising a molten carbonate fuel cell assembly and an internal reforming apparatus that produces hydrogen fuel from hydrocarbon gas. The fuel cell system further comprises hydrogen separation and recovery device (8), which separates and recovers the unspent hydrogen in the anode exhaust. See Column 1, Lines 43-56.

With respect to claim 4, it is well known in the art that molten carbonate fuel cell can be operated at voltages ranging from 0.55 to 0.8 volts as evidenced by Baker et al. (US 3,522,101), Example 2.

With respect to claim 6, Farooque teaches the oxidant is air.

With respect to claim 7, Farooque teaches the use of methane as the fuel. See Column 2, Lines 22-29.

With respect to claim 8, Farooque teaches the heat provided by the hydrogen for the gasifier (5). See Column 2, Lines 42-53.

With respect to claim 11, Farooque teaches the unspent hydrogen in the anode exhaust is recycled back to the anode inlet. See Figure 1.

With respect to claim 12, Farooque teaches the anode exhaust stream comprises CO, CO₂, steam and unspent fuel. See Column 2, Lines 54-61.

With respect to claim 15, Farooque teaches the fuel cell system comprising a shift converter and a hydrogen separation and recovery device. See Column 2, Lines 54-61.

Farooque is silent to the mole fraction of hydrogen at the anode outlet. However, Farooque discloses the hydrogen content in the exhaust stream can be manipulated by converting any CO in the stream to hydrogen. See Column 2, Lines 53-61.

Therefore, it would have been obvious to one of ordinary skill in the art to control the mole fraction of hydrogen in the anode exhaust between 0.1 to 0.5, because Farooque discloses converting the carbon monoxide in the exhaust stream can modify the amounts of hydrogen in the anode exhaust.

Farooque is silent to the system comprising a water condenser for the anode exhaust.

Nakamura teaches a fuel cell system comprising a cooling water, a cooling water pump, a heat exchanger, a fuel-side condenser and an oxidizer-side condenser that

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cool exhaust fuel gas and the exhaust oxidizer gas discharged from the fuel cell to condense content water vapor (Abstract; Fig. 1; 3:45-60, 6:15-20, 9:50-55).

Therefore, it would have been obvious to one of ordinary skill in the art to use add a condenser downstream of the fuel cell system of Farooque, because Nakamura teaches the use of the condenser to condense content water vapor in the exhaust.

3. Claims 1-4, 6-8, 10, 15, 17 & 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over US 2003/0035983 (Ukai) in view of US 2004/0229092 (Take) and US 7,052,790 (Nakamura).

With respect to claims 1 & 3, Ukai et al. teach a fuel cell system comprising a reformer (41) and a polymer electrolyte fuel cell comprising a cathode for receiving a compressed air and an anode for receiving the hydrogen stream. See Figures 1-4, embodiment 3. However, Ukai et al. do not teach the fuel cell system further comprising a separation unit in fluid communication with the fuel cell assembly. Take discloses a fuel cell system comprising a hydrogen separator (68) that is used to separate the hydrogen from the anode exhaust gas. See Embodiment 12. Therefore, it would have been obvious to one of ordinary skill in the art to incorporate a hydrogen separator onto the fuel cell system of Ukai et al., because Take teaches the use of a hydrogen separator to separate the hydrogen from the anode exhaust stream.

With respect to claim 2, Ukai et al. teach the utilization rate of hydrogen supplied is 60 to 80%. See paragraph 190.

With respect to claim 4, it is well known in the art that polymer membrane fuel cell can be operated at approximately 0.7 volts as evidenced by Wheat et al. (US 2004/0197624 A1), paragraph 5.

With respect to claim 6, Ukai et al. teach the use of air as oxidant. See Figure 3.

With respect to claim 7, Ukai teaches the use of methane as the fuel. See paragraph 161.

With respect to claims 8 & 11, Take teaches the waste heat is used for the steam reforming reaction of the hydrocarbon in the reformer (3). See Embodiment 12.

With respect to claim 10, Take teaches the fuel cell can be a solid oxide fuel cell. See abstract.

With respect to claims 12 & 15, Take teaches the anode exhaust stream comprises carbon monoxide, carbon dioxide, steam and unspent fuel. See paragraphs 52-55.

With respect claim 17, Take teaches the hydrogen separator has a palladium membrane. See Embodiment 12.

Ukai and Take are silent to the system comprising a water condenser.

Nakamura teaches a fuel cell system comprising a cooling water, a cooling water pump, a heat exchanger, a fuel-side condenser and an oxidizer-side condenser that cool exhaust fuel gas and the exhaust oxidizer gas discharged from the fuel cell to condense content water vapor (Abstract; Fig. 1; 3:45-60, 6:15-20, 9:50-55).

Therefore, it would have been obvious to one of ordinary skill in the art to use add a condenser downstream of the fuel cell system of Ukai and Take, because

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Nakamura teaches the use of the condenser to condense content water vapor in the exhaust.

4. Claims 13, 14 & 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over US 5,084,362 (Farooque) and US 7,052,790 (Nakamura) as applied to claim 1 above, and further in view of US 2004/0202914 (Sridhar).

The teachings of Farooque and Nakamura as discussed above are incorporated herein.

Farooque and Nakamura are silent to the system comprising a carbon dioxide separator.

Sridhar discloses a fuel cell system comprising a carbon dioxide separator (405) to separate the carbon dioxide before the anode exhaust is discharged to the ambient. An adsorption /absorption based separator is sued. See Figure 9, paragraph 93.

Therefore, it would have been obvious to one of ordinary skill in the art to use add a carbon dioxide separator downstream of the fuel cell system of Farooque, because Sridhar teaches the use of the separator to separate the carbon dioxide before the anode exhaust is discharged to the ambient.

5. Claims 13 & 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over US 2003/0035983 (Ukai) and US 2004/0229092 (Take) as applied to claim 1 above, and further in view of US 2004/0202914 (Sridhar).

The teachings of Ukai and Take as discussed above are incorporated herein.

Ukai and Take are silent to the system comprising a carbon dioxide separator. Sridhar discloses a fuel cell system comprising a carbon dioxide separator (405) to separate the carbon dioxide before the anode exhaust is discharged to the ambient. An adsorption /absorption based separator is used. See Figure 9, paragraph 93.

Therefore, it would have been obvious to one of ordinary skill in the art to use add a carbon dioxide separator downstream of the fuel cell system of Ukai and Take, because Sridhar teaches the use of the separator to separate the carbon dioxide before the anode exhaust is discharged to the ambient.

Response to Arguments

Applicant's arguments filed 8/16/07 have been fully considered but they are not persuasive.

Applicant argues Farooque doesn't teach separation of water from the anode exhaust stream and recycling of that water separated from the anode exhaust.

In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). The claim limitations are rejected under the combined teachings of Farooque and Nakamura and as such the combined teachings obviate the claimed invention.

Applicant alleges Farooque teaches using unspent fuel combined with water or water vapor to drive the turbo compressor. This statement is incorrect because

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Farooque teaches using steam recovered from the cathode side exhaust to run the turbo compressor (Fig. 1, 3:1-40). The steam from the turbo compressor is then combined with the hydrogen supply line for the fuel cell, same as applicant. As discussed above, Farooque is silent to recovering the water from the anode exhaust, but clearly teaches recovering steam and water from the fuel cell system to improve efficiency (1:40-55; 2:20-55). Nakamura teaches recovering water from either or both the anode exhaust and the cathode exhaust (3:45-60; 6:15-20; 9:50-55). So Nakamura teaches it is well known in the art to recover water from one or both exhaust lines. Furthermore, Nakamura teaches another method of collecting more water for the use in the fuel cell system by recovering water from both the anode and cathode exhausts.

Applicant argues, "Take does not foresee the use of a separation unit for this purpose, and the very fact that Farooque specifically teaches combining the unspent fuel with steam, indicates that the references either cannot establish a prima facie case of obviousness of claim 1 because the recitations are simply not taught".

In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). The claim limitations are rejected under the combined teachings the prior art and as such the combined teachings obviate the claimed invention. Furthermore, applicant has provided no evidence why the reference could not be combined.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

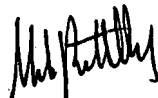
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Keith Walker whose telephone number is 571-272-3458. The examiner can normally be reached on Mon. - Fri. 8am - 5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Ryan can be reached on 571-272-1292. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

K. Walker

MARK RUTHKOSKY
PRIMARY EXAMINER



11.8.2007